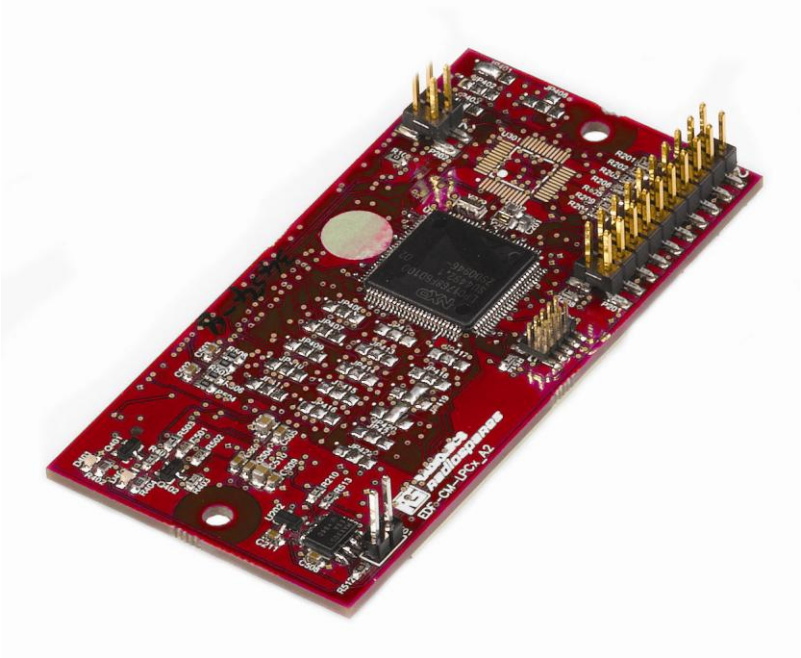
Embedded Development Platform

Getting Started Guide for LPC ARM-core Command Modules

EDP-CM-1113, EDP-CM-1343, EDP-CM-1768, EDP-CM-2368



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EMBEDDED DEVELOPMENT PLATFORM

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1. Introduction

To get the most out of the EDP platform it's important to understand the concept of the EDP system correctly. This is detailed in the user manual for the Base Boards which can be downloaded as a pdf file **RS EDP-BB-SystemBaseBoard User Manual Vx**, from the RS EDP website.

The base boards come in both 2 position and 4 position formats and share a common user manual. Please read this manual to get an understanding of the system.

Each of the Command Modules (CM) and Application Modules (AM) has its own user manual, so again these documents must be read to get an understanding on how to use the modules.

Each of the boards comes with its own suite of software to fully exercise the EDP Application Modules and the peripherals available on the MCU device.

An EDP system usually consists of one Command Module and one or more Applications Modules plugged into a Base Board. A minimum system just has a Command module and Base Board, for example a simple web server operating through an Ethernet connection.

The Command Module dictates whether the whole system uses a supply voltage of +3.3V or +5.0V. This particular CM module use a +3.3V microcontroller (MCU) and so the board is configured as such. The user can check the Vcc_CM signal on the Base Board break-out header to confirm the system voltage.

There are 100 pins on the MCU and these are connected via various link options to the Base Board. The Base Board then routes these signals to the Application Modules thereby allowing the CM Module to communicate with the Application Modules.

As many of the MCU pins have more than one function it can make the mapping of the connections rather complex so there are additional support documents available to help you with this. The first is the Pin Allocation Spread Sheet. One spread sheet is available for each of the CM Modules. The one for the NXP family of ARM-based modules is called:

Pin Allocation - 100 pin NXP Command Module Rev xx

This spreadsheet also forms part of the User Manual for the LPCxxxx CM module. It details which pins are mapped to the Base Board backplane and the various link options which need to be configured to connect them accordingly.

To get an appreciation of how the Application Modules are mapped to the backplane and how the CPU Module can connect to them, a Mapping Aid exists. The one for the LPC1768 module is called:

Mapping Aid RS-EDP NXP LPC1768 Rev xx
(Name may vary slightly for other NXP modules)

This mapping aid also forms part of the User Manual for the LPC Module and at a glance you can see what resources are required to get the best out of each Application Module.

Other useful documents you will need are the circuit diagrams for the modules you wish to use. These are contained in the back of each user manual.

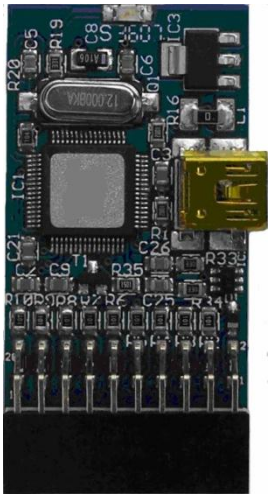
So before you start to use the RS EDP system make sure you have to hand the following documents:

- Base Board User Manual
- Appropriate CM module User Manual
- Application Module User Manuals (as required)

2. Prepare to run the 'Hello World' Program

Program development is performed on a PC running suitable software, and a plug-in hardware 'dongle' is required as a programming/debug interface between the PC and the CM module.

2.1 Software requirements

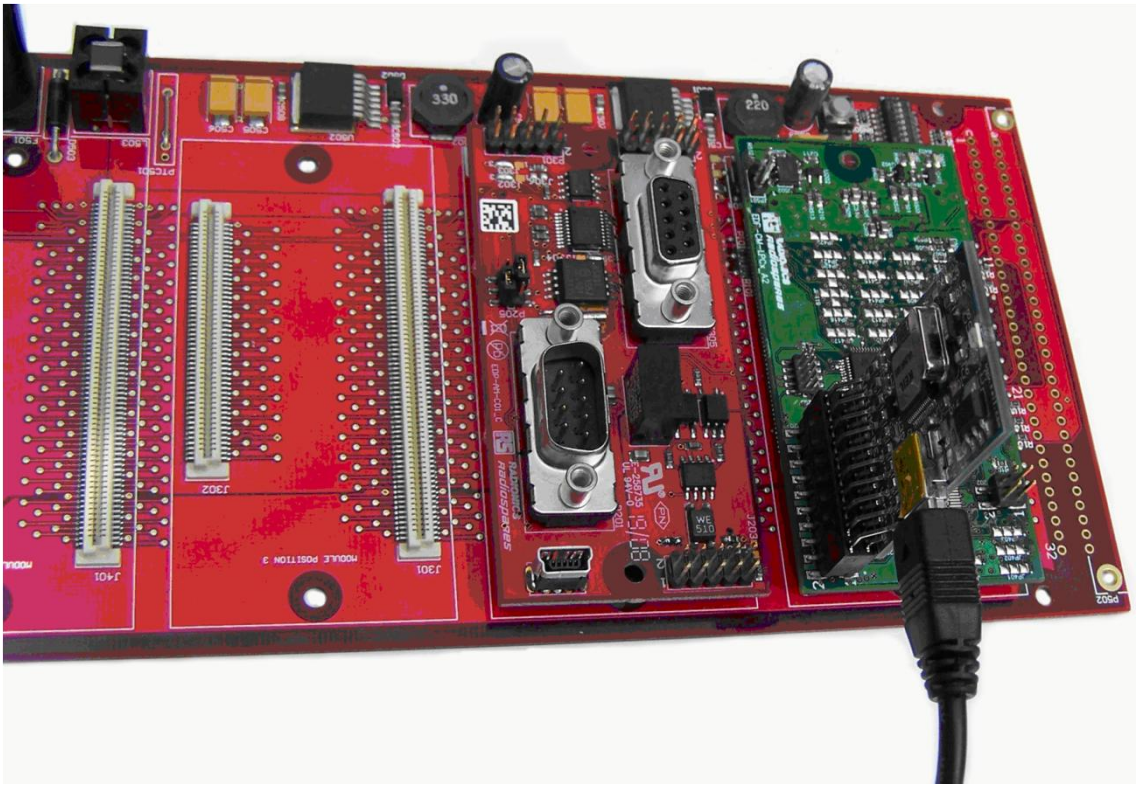


To build, download and run your first program you will need to have a suitable Integrated Development Environment (IDE) running on a PC. If necessary download Keil µVision 4 for ARM processors from the Keil website. This is a full-featured free trial version that is limited to 32Kbytes of output code. You can upgrade to the full version later or try one of the alternatives discussed in an appendix to the User Manual. The IDE handles all aspects of code production as it contains a source code editor, assembler, C compiler, Flash programmer and debug tools.

2.2 Hardware requirements

The Keil IDE needs a hardware programming/debug dongle which allows the CM module to be linked via USB to the IDE running on the PC. If you already run Keil µVision then you should already have the interface in the form of a ULINK2 module. If not, then a suitable unit can be obtained from RS under the part no. 703-9241.

The software inside the dongle is upgraded automatically by Keil µVision when it is plugged in to the host computer. It supports classic ARM7/ARM9 architectures as well as the later Cortex devices. JTAG and SWD are both supported.

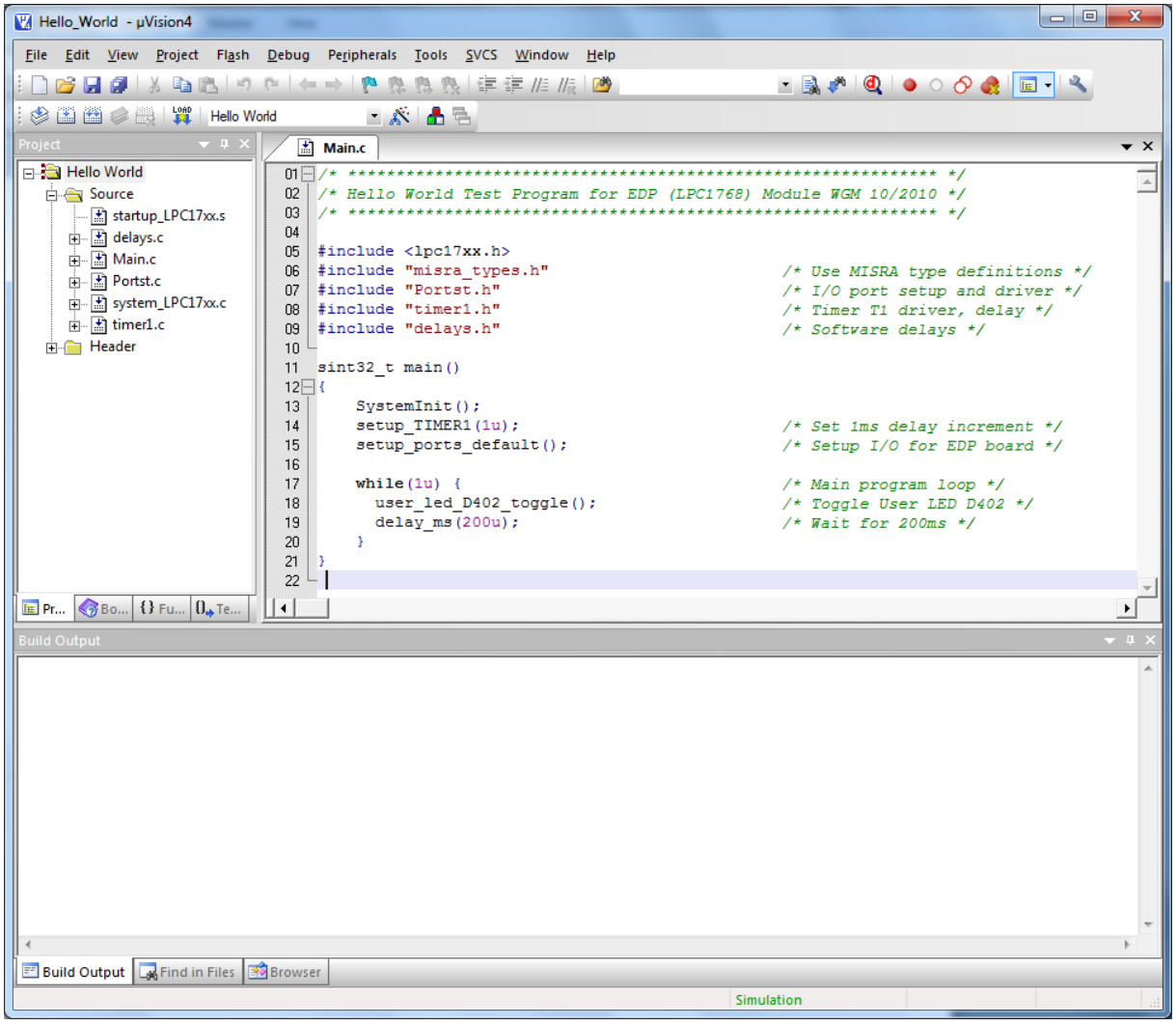


The correct orientation of the dongle on the CM module

3. Build and run ‘Hello World’

3.1 Load the Project

- Plug the dongle into the CM module noting the orientation in the picture above.
- Connect the dongle to a USB port on the host computer.
- Turn on power to the Base Board.
- Download the ‘EDP LPCxxxx Hello World’ folder from the EDP web site to your C: drive.
- Run Keil µVision 4 on the host computer.
- Click on **Open Project** from the Project menu and navigate to the ‘EDP LPCxxxx Hello World’ folder. Double click on ‘Hello_World’ to load the project files.
- The screen will now appear as below:



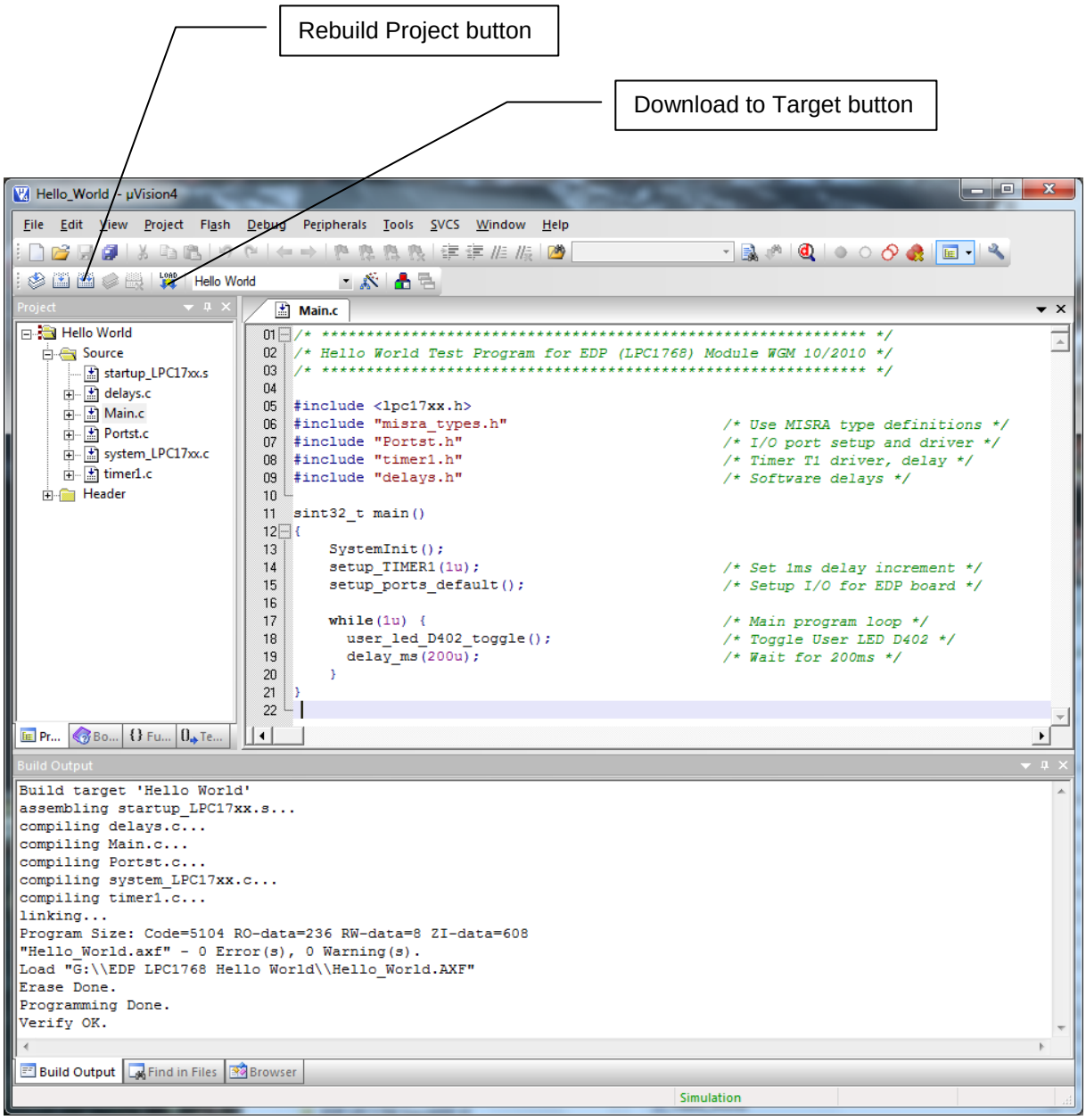
Note that the folder already contains all the necessary source code files together with the Build files produced by the IDE. To demonstrate the procedure we will now perform the Build and Link operations.

3.2 Build the Project

- Click the **Rebuild** button on the Build toolbar (see picture below). The various files are compiled and linked, progress being reported in the Build Output pane.
- If there are any compilation errors they will be reported here and linking will not take place. Double clicking on a particular error message will take you to the offending line of source code in the edit pane above.

3.3 Download and program target Flash memory

- If zero errors are reported then the code can be downloaded to the target MCU and programmed into its Flash memory. Click on the **Download** button on the Build toolbar.
- Press the Reset button on the EDP Base Board and one of the two yellow User LEDs on the CM module should begin flashing indicating a successful download and program.



4. Build your own Project

The procedure for building and programming your own project is exactly as outlined above using your own project folder containing source (.c) and header (.h) files.

The Hello World program does not use any EDP Application Module hardware but your projects probably will, so the necessary drivers will need to be included in your folder. Download these from the EDP web site. Note that MCU-specific drivers will also be required: see example above.

4.1 Creating a new Project

- Click on **New µVision Project** from the Project menu and navigate to your project folder containing your source files.
- Type in a project name and click on **Save**. You will now be asked to select a target MCU device. In this case select 'NXP' and then the part number from the drop-down list.
- Right-click on 'Source Group 1' in the Project pane (expanded from 'Target 1') and then on '**Add Files to Group**'. Select and **Add** all your source (.c) files. You can rename 'Target 1' and 'Source Group 1' and create other groups for other files by right-clicking on 'Target 1' and then clicking on **Manage Components…**
- Double-click on file: system_LPCxxxx.c and select the **Configuration Wizard** tab. Locate the 'Power Control for Peripherals Register' and tick the boxes of peripheral systems used by your project. Resave the file when finished. There may be other settings that need changing, but the defaults should get things running.
- Build and load the project as before.

5. Conclusion

This is only a basic introduction to the Keil IDE; more complete information and a description of all the debugging features can be found on the Keil website.

Refer to the User Manual for these CM modules for details of alternative program development tools which can be used with EDP.

6. Appendix 1 EDP I²C Bus Device Addresses

8-bit address format is used: the LSB is reserved as the read-write bit. These addresses are defined in file: I2C-Directory.h

BaseBoard

BB_DIP = 0x40

8-bit DIP Switch
Address set by jumper link JP501 providing possible range of addresses: 0x40 (default), 0x42.

BB_EEPROM = 0xA2

Serial 4KB EEPROM memory
Address set by jumper links J601 to J603 providing possible range of addresses: 0xA0, 0xA2 (default), 0xA4, 0xA6, 0xA8, 0xAA, 0xAC, 0xAE.

Communications Module EDP-AM-CO1

CO1_RTC = 0xA0

Real-Time Clock and SRAM
Address set by jumper link J304 providing possible range of addresses: 0xA0 (default), 0xA2.

Digital I/O Module EDP-AM-DIO54

DIO54_Out = 0x46

Digital output latch
Address set by jumper links B305 to B307 providing possible range of addresses: 0x40, 0x42, 0x44, 0x46 (default), 0x48, 0x4A, 0x4C, 0x4E.

DIO54_In = 0x44

Digital input latch
Address set by jumper links B302 to B304 providing possible range of addresses: 0x40, 0x42, 0x44 (default), 0x46, 0x48, 0x4A, 0x4C, 0x4E.

Analogue Input Module EDP-AM-AN16

AN16_ADC = 0x6A

12-channel 10-bit Analogue to Digital Converter

AN16_Pot = 0x58

Digital Potentiometer for setting filter cut-off frequency of channels AN0 and AN1
Address set by jumper links J305 & J306 providing possible range of addresses: 0x58 (default), 0x5A, 0x5C, 0x5E.

Note that jumper links J204 & J205 select between CTRL_I2C (default) and I2C_GEN0 bus channels.

Dual BLDC Motor Module EDP-AM-MC2

MICROCHIP_MOTOR_DRIVER_BASE = 0x80

dsPIC U201
Address set by jumper links J201 to J203 providing possible range of addresses: 0x80 (default), 0x82, 0x84, 0x86, 0x88, 0x8A, 0x8C, 0x8E.
dsPIC U202
Address set by jumper links J205 to J207 providing possible range of addresses: 0x80, 0x82 (default), 0x84, 0x86, 0x88, 0x8A, 0x8C, 0x8E.

Note that spare addresses allow up to four MC2 modules per base board

Miscellaneous

SRF08 = 0xE0

Daventech SRF08 Ultrasonic Rangefinder module